Upside-down lower jaws, pivoting upper jaws, and bendable teeth: scraping feeding catfish do it their way

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Most South American suckermouth catfishes (Loricariidae) scrape food off substrates, using intensely modified jaws to scrape algae, detritus, and other small food items. The jaws can't bite or even close the mouth. Teeth demonstrate rake-like forms, and in some species apparently avoid breaking by bending. After gathering anatomical and biomechanical data of loricariids and related taxa demonstrating more plesiomorphic traits, we aim to explain how a relatively simple evolutionary transformation of jaw shape and position initiated a novel jaw mobility, with lever systems having been strongly altered, and muscle functions having completely different effects. Loricariid upper jaws pivot around a communal suspension point; lower jaws point medially instead of rostrally, are independently movable, and bear teeth on the ventral side due to evolutionary bone torsion halfway the jaw bone. Still the same jaw muscles act on them, moving the jaws backward instead of dorsally, and rotating them around their own axis, scraping the teeth along a large surface. Teeth experience sideward instead of perpendicular forces, and their shape is well suited for this purpose. In some algae-eating species teeth are only partially mineralized near the base and can bend over 90°, so avoiding breaking too easily. We studied the microstructure and mineralization of the teeth using serial sections, staining, micro-CT scanning, SEM and TEM, discerning hard parts where teeth experience compression, and truly soft parts where the tooth material is stretched during feeding. Jaw and teeth structure can be considered key transformations in the loricariid trophic apparatus.

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